

# X-BAND HIGH RATE MISSION DATA TRANSMITTER (HRT-440)

Proven design with state-of-the-art encoding

## Features

- SQPSK Modulation
- Up to 440 MBPS data rate (uncoded)
  - 384 MBPS w/LDPC Encoding
  - Optional dual data rate capability
  - Data rates can be custom ordered
- X-Band Frequency: 8200.5 MHz
  - Option for Ka Band output
- Built-in commandable test patterns
  - 223 - 1 PN pattern included
- Forward Error Correction Coding
  - CCSDS (8160,7136) LDPC
  - Optional Codes
  - CCSDS Reed-Solomon
  - Convolutional Encoding
- Redundant 8-bit parallel LVDS data interfaces
  - Output source clock for synchronous operation
- Redundant 8-bit Serial Command & Telemetry
- DRO/TCXO Frequency Source
- Radiation and SEE Tolerant
- Mass Less than 5 Pounds
- Envelope < 160 Cubic Inches
  - 8.0" x 6.6" Footprint
- Qualified over -34 to +71°C
- Internal High Efficiency Power Converter 22 to 36 VDC Input Range
- Internal level controlled output for driving Phased-Array Antenna or High-Power Amplifier
  - Optional 15 W SSPA available



General Dynamics' space-qualified HRT-440 Mission Data Transmitter will maximize your data downlink at X-Band. Implementing the powerful new CCSDS Low Density Parity Check (LDPC) code, the performance of this state-of-the-art unit approaches the Shannon theoretical limit for channel capacity. Standard operation is SQPSK modulation at the traditional 8.2 GHz downlink band, with options available for Tracking and Data Relay Satellite System (TDRSS) Ku-Band or Ka-Band operation.

The HRT-440 utilizes the latest space-qualified and radiation-hardened FPGA, ASIC, and GaAs MMIC technology. Implemented using space-proven design techniques from our line of transponders, the result is a high-performance and reliable unit with a very small size, low mass and power.

The transmitter includes a low power, level controlled output suitable for driving power amplifiers. An optional 15 Watt solid state power amplifier (SSPA) can be provided if desired for feeding downlink antennas.

# X-Band High Rate Mission Data Transmitter (HRT-440)

## Performance Characteristics

### RF

- Output Frequencies: X-Band: 8.2005 GHz
  - Optional TDRSS Ku-Band and Ka-Band capability
- Output Power: +10 dBm Nominal
- Modulation: SQPSK
- Data Rate:
  - Up to 440 Mbps Uncoded
  - Up to 384 Mbps (8160,7136) LDPC coded
  - Option for selectable dual-data rates

### Data Encoding/Formatting

- Standard Forward Error Correction: (8160,7136) LDPC
  - Standard Near-earth code per CCSDS 131.1-O-2
  - Frame Length: 892 bytes data, 128 bytes parity, 4 bytes ASM
  - FEC bypass on command
- Framing ASM Word: 1A,CF,FC,1D Hex
- Randomization:
  - Mission Data plus Parity randomized per CCSDS standard
  - Randomizer bypass on command
- Pulse Shaping: Custom analog pre-modulation filtering.
- Optional FEC Codes:
  - (4088,3360) LDPC
  - (255/223) Reed-Solomon with interleave depth  $l=1$  to 5
  - Rate  $\frac{1}{2}$  Convolutional

## User Interfaces/Connectors

- Primary User Data: 8-Bit Parallel w/source clock /25 skt Micro-D
- Redundant User Data: 8-Bit Parallel w/source clock /25 pin Micro-D
- Command/Telemetry:
  - Primary/Redundant: 801 UART /21-skt Micro-D
- Discrete Telemetry:
  - Primary: Voltage, Temperature, PLL Lock, more /21 pin Micro-D
  - Redundant: Voltage, Temperature, PLL Lock, more /21 pin Micro-D
- DC Power:
  - Primary/Redundant: 28VDC power /9 skt Micro-D
- RF Output /SMA Jack

## Input Power

- Operating Voltage: 22.0 – 36.0 VDC
- Input Operating Power: 15 Watts maximum

## General

- Mass: 5 lbs (2.3 Kg) maximum
- Size: 8.0"L x 6.6"W x 3.0"H (20.3cm X 16.8cm X 7.6 cm) maximum envelope
- Temperature Limits: -34° C to +71° C (Qualification)  
-24° C to +61° C (Acceptance)
- Radiation: TID > 40 krad (Si)
  - Most parts are >100 kRad (call for availability of radiation upgrades)  
SEE tolerant

## GENERAL DYNAMICS Advanced Information Systems

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